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ordinated to an artistic or decorative treatment. In time we shall go further than that and attempt in some degree to reflect current botanical ideas in the grouping of our plants. Let me illustrate my meaning by a good example. The succulent house is generally conceded to form one of the most interesting and stimulating exhibits to be seen at Kew—not merely from the weird and grotesque forms assumed by the individual plants, but chiefly because here you have assembled together plants of the most varied affinity having the common bond of similar adaptations to a like type of environment. The principles that underlie the arrangement of the best sort of museum may be applied with advantage in the case of a garden, and with tenfold effect; for is not a live dandelion better than a dead *Welwitschia*? This feature, introduced as it would be with moderation and discretion, would immensely enhance the value of the gardens both to the student and general visitor.

But to return from this digression: on the whole the time seems ripe for the new departure. Fresh lines are opening up in systematic botany that call for special provision. Now it was evident from the circumstances of the botanical renaissance twenty-five years ago that when it acquired strength some readjustment between the old and the new would have to be made. The thing was inevitable. The administrative acts of recent years all point in the same direction. The founding of the Jodrell Laboratory, the enhanced efficiency of the gardens, the great extension of the herbarium building, all help to pave the way. But more is wanted. Reference has been made to the advantages that would attend the migration from the Natural History Museum. But it is most important of all to devise a mechanism for securing a flow of recruits to carry on the work. This

would follow in the wake of a *rapprochement* with the schools on the lines already sketched out. Difficulties, no doubt, will be encountered in the initial stages of a reorganization, but these are inseparable from our bureaucratic system. A very hopeful sign is the readiness which the government has shown in instituting inquiries in the past. That nothing has come of them may be attributed primarily to the attitude of botanists themselves. If they can unite on any common policy, there should be no serious delay in giving it effect.

THE CORRESPONDENCE SCHOOL—ITS RELATION TO TECHNICAL EDUCATION AND SOME OF ITS RESULTS.¹

At the 1899 meeting of the Society for Promotion of Engineering Education, held at Columbus, Ohio, a paper was presented by Professor Edgar Marburg, entitled 'The Correspondence School in Technical Education.'² This paper aroused considerable interest, and was discussed quite generally, with the result that a committee on industrial education was appointed, of which Professor J. B. Johnson was chairman. This committee reported at the New York meeting in the following year.³

At the time Professor Marburg prepared his paper the total number of students enrolled in the International Correspondence Schools was about 80,000, and at the time the committee made its report the number of students enrolled was about 181,000. It was impossible at that time to furnish reliable figures in regard to the work being

¹ Read at the Ithaca meeting of the American Association for the Advancement of Science, June 30, 1906, before Section D, Mechanical Science and Engineering.

² *Proceedings of the Society for the Promotion of Engineering Education*, Vol. VII., p. 80.

³ *Proceedings of the Society for the Promotion of Engineering Education*, Vol. VIII., p. 28.

accomplished; consequently, both Professor Marburg's paper and the report of the committee were, in some respects, unsatisfactory and unjust to the correspondence school.

In order that you may understand several of the facts that I am about to bring to your attention, it will be well to consider the enrolment figures for the various years since the organization of the International Correspondence Schools.

From October 1, 1891, to December 31, 1893, the total number of students enrolled was.....	3,105
The number of new students enrolled to December 31, 1894.....	2,509
The number of new students enrolled to December 31, 1895.....	4,491
The number of new students enrolled to December 31, 1896.....	6,530
The number of new students enrolled to December 31, 1897.....	13,677
The number of new students enrolled to December 31, 1898.....	38,572
The number of new students enrolled to December 31, 1899.....	71,885

Since December 31, 1899, we have been enrolling students at the rate of more than 100,000 per year, the total number to and including June 27, 1906, being 902,906.

It will be noted that up to and including the enrolment for 1897, the increase in the number of students was comparatively even. After this date, however, the number of students enrolled increased very remarkably. There are two reasons for this sudden increase in the enrolment. Previous to January 1, 1898, the students received their text-books in the form of paper-covered pamphlets, averaging about fifty pages each, and these were sent only one at a time to each student as he progressed with his studies. The result was that if a student failed to complete his course, he had on hand not more than two instruction papers in advance of the last one he had studied. This tended to create great dissatisfaction, and, to overcome it,

we reprinted the entire text of the courses, and sent to every student, at the time of his enrolment, a set of what we term bound volumes. These volumes contained every thing that the student would receive in connection with his course of instruction, and if he failed to complete the course he had his bound volumes at any rate, and could continue studying by himself, if he so desired. This feature resulted in a great increase in the number of students. Further, previous to the latter part of 1897, the students were obtained solely by newspaper and magazine advertising. They were all enrolled through the mails and no pressure was applied to induce them to become students. About the time we began printing bound volumes we began to organize a force of solicitors. These solicitors interviewed the prospective student personally, and naturally did everything they could to increase the number of students. The result is shown by the figures above quoted.

In 1899 and 1900, the number of new students enrolled was so great, relatively speaking, that it was impossible to furnish any definite figures to the committee or to Professor Marburg to substantiate our claims, and we ourselves could not predict definitely what the outcome would be. The enrolment has been comparatively steady during the past seven years, and we are now better able to present to the society facts and statistics that will enable you to judge of the work we are doing. At the same time, we can not give you full and complete information in regard to the benefits derived by our students. We have received hundreds and thousands of letters from students who have never sent in any work at all to be examined and corrected, or who have sent in work on only one subject—as for example, arithmetic—in which letters they have stated that they

have derived great benefit from their courses. On inquiry we found that these students had studied from their bound volumes, and that the text had been so carefully prepared that they did not desire to go to the trouble of writing out the answers to the examination questions; and not caring whether or not they obtained a diploma or certificate, they never sent in any work.

Before pursuing this subject further, it will be well to consider the character of the courses we offer, and the reason why we offer so many different courses. Our system of education is based on an idea that is almost directly opposite the views held by the regular schools and colleges. The regular technical school or college aims to educate a man broadly; our aim, on the contrary, is to educate him only along some particular line. The college demands that a student shall have certain educational qualifications to enter it, and that all students study for approximately the same length of time, and when they have finished their courses they are supposed to be qualified to enter any one of a number of branches in some particular profession. We, on the contrary, are aiming to make our courses fit the particular needs of the student who takes them. If a student is employed as a helper in some shop, and desires to become a stationary engineer or draftsman, or bookkeeper, or to follow any other special branch of industry, we can offer him a course that will fit him for the particular position he has in mind. Such a student does not wish or desire to be forced to study anything that is not strictly necessary for him to learn in order to fill the position he is aiming at. Consequently, without citing other instances, it may be stated that every one of our courses, with a few exceptions, perhaps, is a special course. If a person desires to

take up bridge engineering, and does not wish to learn the other branches of civil engineering, we offer him our bridge engineering course. He studies only those subjects that are necessary for him to know in order for him to understand everything we teach in regard to bridge engineering. If the person wishes to study stenography, we offer him our stenographic course. If, however, he wishes to take a course that would correspond to a course in a business college, we offer him what we term our complete commercial course, which includes bookkeeping, stenography and other subjects. If a student desires to study mechanical drawing, and does not wish to take our mechanical or mechanical engineering course, we will offer him our course in mechanical drawing, and will not compel him to study any other subject. There are many persons who already have a good knowledge of mathematics and who have a good general education. They find it necessary to have some knowledge of mechanical drawing, but do not wish to study any other subject. Such a person can take our mechanical-drawing course and learn the latest and best methods in use in the leading drafting rooms of the country.

Considered from a pedagogical standpoint, our methods are a distinct departure from any that have previously been tried. What has been stated here with regard to the methods of the International Correspondence Schools, applies with equal force to a number of other correspondence schools. These remarks do not apply to all correspondence schools, however, for the reason that some of them are conducted along an entirely different line. Attempts have been made to conduct correspondence schools by means of what may be termed the regular text-books such as are used in the ordinary school or college. Their plan

is to purchase these text-books, direct the student to study a certain number of pages or chapters and then answer a set of questions. The student's answers are corrected and returned to him, and if he desires to be informed regarding anything not clearly explained in the text, he may write to the schools and obtain the information desired. He proceeds in this way until he has finished the particular text-book he is studying. Such schools, however, have always failed, or at any rate have made very little progress, for the reason that the ordinary text-book is not adapted to the use of a person studying by himself. Another method is that in use by the University of Chicago. The student takes a regular college course, but does a part of the work at home. He can not get his degree, however, without taking about half the course in residence. This plan offers very few advantages over taking a college course in the regular manner. The student must have the same preparation and must do the same amount of work as any other student taking the same course or subject. The only requirement necessary to become a student of the International Correspondence Schools is ability to read the English language and to write it sufficiently well to be understood. Sometimes even this requirement is not fulfilled, as the student will get some one else to write his answers to the examination questions for him, from dictation. This is especially true of students speaking some language other than English. A case came up only a short time ago of a German who was unable to write English, but who induced his wife to translate the text matter to him. He dictated the answers to the examination questions, which she wrote down, and his work was corrected by our instruction department in the usual way. This is not an

isolated case, but is one that occurs with considerable frequency among such students.

Inasmuch as nearly every student has a definite object in view when he takes a course, he naturally objects to anything that will delay him in obtaining the knowledge he desires. As a consequence, we frequently have several text-books treating the same subject. In some cases the text-books differ quite materially both in the amount of ground covered and in the treatment; in other cases they differ very slightly. For example, take the subject of arithmetic. We have a very complete arithmetic that is used in our English branches, teachers' and commercial courses, while for our technical courses the arithmetics are all of about the same size; they may differ slightly in the methods of treatment, but principally in the fact that the examples and illustrative citations, etc., relate to matters with which the student is supposed to be concerned in connection with his course of study. For example: in the arithmetic used in the school of mines, the examples relate to matters pertaining to mining. Another arithmetic—very similar, but having different examples and illustrative citations—is used for the courses in the school of metallurgy. This may appear to be stretching the point considerably, but our chief aim is to keep the student interested in his work and to teach him something bearing directly on the course he is taking in connection with the study of every subject in that course.

As to the results we have accomplished, it is, as before stated, impossible to furnish exact figures. Many students enrol for the purpose of studying certain subjects that will enable them to pass an examination, such as for a license for mine foreman, for engineer, etc. They do not care whether they complete a course or not, pro-

vided they get the information they need in order to pass the examination. Quite a large number of students taking our courses in marine engineering never send in any work at all. They simply take their bound volumes, study from them, pass the examination, and get their license for one of the different grades of engineer. Several years ago, the writer had considerable correspondence with the assistant foreman of the boiler department of the Richmond Locomotive Works. He was very enthusiastic regarding his work, and organized a class of about thirty-five persons employed in the boiler department, most of whom enrolled with us for our sheet-metal pattern drafting course. The superintendent and other officials of the company took great interest in his work, and furnished a room where the class could meet, and furnished desks, tables and other material, and encouraged the men generally in connection with their courses of study. The results, according to the assistant foreman, were extremely satisfactory. However, he did not furnish me with the names of any of the class until about two years after the correspondence was begun. I looked up the record of these students, and found that not a single one of them had ever sent in any work to us for correction. At the same time they were getting great benefit from their courses, and were entirely satisfied with them.

A careful examination of the records of a large number of students, for a number of years, indicates that about 60 per cent. of them send in one or more pieces of work. An examination of the records of our accounting department shows that about two thirds of the students pay in full for their courses. These facts force us to the conclusion that if a student does not pay, he does not study. There is no

connection between the instruction department and the accounting department. Any student who sends in work on a paper will have his work corrected, and will have any questions answered that he may send us, regardless of whether he has paid for his course or whether he is a delinquent. At the same time, it is a fact that if a student does not pay, he does not study; while, if he does pay, as a rule, he does at least a certain amount of studying. Therefore, while our present total enrolment is a little over 900,000, it is not fair to count the actual number of students as being over about 60 per cent. of this, or about 540,000. From the figures and statistics prepared last month, we estimated that 533,000 students had sent in work on the examination questions of one or more instruction papers. From June 1, 1905, to May 31, 1906, the work on the examination questions of 517,849 instruction papers was corrected; 192,739 drawings were corrected; and 6,364 phonograph records, made by students in our language courses, were received and examined. The total number of pieces of work during this period, received from students, was, therefore, 716,952.

We compiled, about a year ago, a book giving the names, addresses and records of students who had completed about one third or more of their courses. There was excluded from this list those students taking a single subject, such as arithmetic, algebra, bookkeeping, etc., and also all the students in our school of electrotherapeutics—a total altogether of 40,261 names. The average enrolment during the period when the names were being taken off was 798,960. Hence, the number of students, living and dead, who might have been included in the book was 758,700. Taking 60 per cent. of these as active students, the number to be so counted is 455,220. The

number of names included in the book is 75,774, which is about 16.6 per cent. of the number of active students. That is, 16.6 per cent. of the number of active students have completed one third or more of their courses, as shown by our records. The number of students who have entirely completed their courses, passed their final examination and been awarded a certificate or diploma is 12,143 (up to and including June 27, 1906), or about 2.6 per cent. of the total number of active students. Although this percentage may appear low, it should be borne in mind that it will greatly increase from now on. Instead of the schools being fifteen years old, they are really only about eight or nine years old, as measured by the bulk of the enrolments. A larger proportion of students are completing their courses now than at any time in the past. And in consequence of the exceedingly large enrolment at the present time, the number of graduates will increase very materially in the next few years.

Between February 7 and April 21 we issued over 600 diplomas, an average of 240 per month. The average for the same period next year will exceed this, and may average as high as 300 per month. In consequence of a falling off in the amount of work received during the hot weather, this average will not be maintained for the whole year; but it is safe to assume that between now and this time next year, at least 2,700 diplomas will be issued. This number will be increased during the following year. The percentage of increase in the number of students receiving diplomas will be far greater than in the number of new students enrolling. This conclusion is justified by the following fact: The book before referred to which contains the names and addresses of over 75,000 students is the second edition, and was compiled between May 16 and August

9, 1905. During this period, the average enrolment was 798,960. The first edition of the book was compiled between January 18 and March 17, 1904, and the average enrolment during that period was 642,378. It was previously shown that 16.6 per cent. of the number of active students was included in the second edition of the book. I have no figures to show the exact number of names excluded corresponding to the 40,261 that were thrown out in making the previous estimate, but based on the number of students enrolled during the period that the first edition was being compiled, the number to be excluded would be 32,370. The number of names, therefore, considered in connection with the compilation of the first edition, was 610,000. Hence, the number of active students at that time would be 60 per cent. of this, or 366,000. The number of names given in the first edition was 54,500, or 14.9 per cent. of the number of active students. In the short space of sixteen months the number of persons who had become eligible to have their names inserted in the book had increased 1.7 per cent. This is a remarkable showing, and we have every reason to expect that the number of students completing their courses will increase in the same or a greater proportion.

Some of the reasons why students do not complete their courses of study have been mentioned above. It may be of interest to consider other reasons why they fail to complete their courses. As a rule, if a student has only his own inclination to induce him to devote his spare time to obtaining an education, he feels the need of an education and knows the benefit it will be to him to possess it. At the same time, most persons do not possess sufficient grit and determination to persist in the line of work they have laid out for themselves, especially when they receive no

special encouragement to do so. We do all we can to encourage the student, both by means of letters and by having our agents call on them. But there are many other influences that tend to discourage a student and to induce him to drop his course. Many students are obliged to stop studying on account of being forced to work very long hours and not having the time. Other students have an idea at the time they enrol that it will be a comparatively easy matter to study the course, and they become discouraged when they find they must work hard in order to understand the subject. Such students either do not begin to study, or else they cease studying almost as soon as they enrol.

A large proportion of our students are not only ignorant of the subject studied, but are also ignorant of *how* to study, that is, they have formed no habit of this kind, and it is necessary for us to teach them how to study, as well as the subject they do study. A large number have enrolled simply for the purpose of securing the textbooks, as these are not for sale and can be obtained in no other way. Some enrol because their friends are enrolled. At the same time, when they receive their textbooks and look them over, they become discouraged and never make any attempt to study. Some students may start in and work very well during the winter months and early spring, but during the summer months they stop for various reasons, perhaps temporarily; but later, when the weather has become cool again they have laid aside their enthusiasm and do not resume, or, if they do, the attempt is spasmodic, and the studies are soon abandoned.

We have absolutely no way of compelling a student to study. We can not threaten him with suspension or expulsion. We have no inducement that we can offer him beyond prizes, and these do not seem

to produce the desired effect; and the student himself frequently has direct encouragement to give up his studies, by reason of adverse criticism of his relatives and friends.

A considerable number of students may cease studying for a long time—several years in fact—and then begin again, and go on with their courses. Quite a number of students have objected to doing the work we require of them, saying they did not have the time, and stopped sending work on this account. We know of one student who finished all the work in our mechanical course (which we usually estimate will require about three years to complete), with the exception of one of the papers on machine design. This student did good work, and received very high marks. At the same time, he would not complete the subject of machine design, because, he said, he did not have time to make the drawings that we required in connection with these papers. His course was of great benefit to him, and when we heard from him last he was superintendent of a large power plant, and was receiving a very good salary. On account, however, of his not having conformed to our requirements, we were unable to give him a diploma, although he had actually completed the entire work of the course with the exception of this one paper. This is by no means an isolated case, but it is one that has occurred with considerable frequency. In some cases, a student will not complete a course for the reason that it does not contain, in his opinion, as much on certain subjects as he thinks he should receive, and he does not care to study the course for the educational features only.

When we began to teach we did not know what the result of the experiment would be; and, furthermore, we did not have the demand for such a wide range of

information on certain subjects as we have now. During the last three or four years we have been very busy in rewriting all of our older courses. These new courses will cover the subjects more completely than the older ones did, and there will be a larger number of subjects than were included in the former courses. Inasmuch as the new courses will meet the demands of our students better than the old ones did, we expect that there will be a great increase in the number of students finishing such courses, or, at any rate, in the number of students studying a part or all of the courses.

J. J. CLARK.

THE PRESENT NEEDS OF THE HARVARD MEDICAL SCHOOL.¹

EVERY one who has visited the new buildings on Longwood Avenue must feel that, so far as spacious and well-lighted laboratories are concerned, the Harvard Medical School has all the laboratory space which it will require for many years to come. What it needs now, so far as these laboratory buildings are concerned, is sufficient endowment to equip, man and run them in a manner commensurate with the laboratory opportunities afforded. The school has at the present time but a small endowment fund. A much larger one is necessary, because it is becoming more and more difficult every year to induce capable men to enter the laboratory branches of medicine. This failure to take up laboratory work as a profession is due chiefly to the salaries, which, in consequence of the greatly increased cost of living and the greater returns offered by clinical branches of medicine or by business, have become entirely inadequate. No man can live in a manner becoming the position on the salaries now paid in the laboratory departments.

¹ Read before the Harvard Medical Alumni Association at its annual meeting, June 26, 1906.

The laboratory departments have, however, this advantage over the clinical departments. They have the laboratories and so can call the ablest men from any part of the world to work and teach in them. There is nothing to prevent these departments from attaining the highest rank except a lack of endowment sufficient to attract the best men and to provide funds for necessary expenses. With this provision the best results, both as regards the education of students who are to practise in the community, as regards men trained to become the medical teachers of the future, and as regards advancing medical knowledge and investigation, can be produced.

Much as adequate endowment for the laboratory departments is needed, however, lack of endowment for these departments is not the greatest need of the school at the present time. First-class laboratory departments alone will never make a great medical school. The first function of a medical school is to turn out thoroughly trained practitioners of medicine, and to do that the clinical departments must have opportunities equal to or even greater than the laboratory departments. This is not the case at present. The clinical teachers labor under great disadvantages, owing to the fact that the medical school does not have a hospital of its own and with possibly one exception has no power of appointment of clinical men in a hospital. Consequently the clinical instructors have to do their teaching in the various hospitals of Boston, which all are under different boards of management. These boards are entirely independent of the school and some of them are little inclined to cooperate with it. The resulting difficulties, which most of the clinical teachers have to contend with, are short terms of hospital service; variability in the time of year of hospital services, especially for the younger men; and the inability of the heads of departments to